

Review of “Are precipitation anomalies associated with aerosol variations over Eastern China?”
by Xu et al.

General:

This is a comprehensive study on the precipitation-aerosol relationship over a large region (eastern China) for a long period of time (1961-2010). This work involves processing of large amounts of datasets relating to precipitation and aerosols from ground and satellite observations, including monthly haze data at 2513 stations, daily visibility data at 598 stations, and daily cloud cover data at 753 stations, daily PM_{2.5} data at 946 stations and MODIS satellite data. In addition, aircraft measurements are also included and analysed. There are similar studies for different periods and different regions. A study that covers such a large region for such a long period of time is rare.

Overall, this study is well done with thorough analysis. The results are reliable and solid. This study has made a new contribution to our understanding of precipitation-aerosol relationship and the implications of this study should not be underestimated.

The paper can be improved with more in-depth discussion. In the introduction, the authors can write a more comprehensive literature review on the precipitation-aerosol relationship, such as, what are controversy issues, what are the research gaps and what are the possible underlying mechanisms for various processes. Then the review can lead to what the authors will address in this paper. The conclusions and abstract seem to have different emphasis. What do the authors really like to emphasize? Should the authors also discuss, in conclusion, the spatial correlation pattern between visibility and rainstorms and other issues emphasized in the abstract?

The presentation can be greatly improved. Please pay close attention on the presentation because poor presentation can hamper the readers from understanding the contents in the paper. There are numerous places requiring polishing on presentation and corrections for grammatical errors. Some examples are provided in Specific. The authors can take advantage of the editing service provided by the journal.

Figure 3 shows trends for different rain intensity. Have the authors looked into the total precipitation? What is the trend? What that trend tells us?

Figure 10 can be improved in the presentation and discussion. How significant is the correlation at each level? The statement in line 204 “indicating they were negatively correlated at low boundary layer” is not supported by Figure 10a and 10b.

Specific:

Line 33, delete “It is widely acknowledged that”.

Line 46, give the full expression of CCN IN.

Line 51, use “An earlier study showed” to replace “The study shows”.

Line 75-82 Data, some descriptions on quality control would be helpful.

Line 76-77, some description on MODIS data would be helpful, for example, what is the resolution of the MODIS data? How are the data used in this study?

Line 77, leave space between 200 and mm. Correct the same problem in the rest of the paper. For example, in Lines 78, 79, 94 and 95.

Line 108, Xu et al. (2016) is missing in Reference.

Line 130, delete “trends” and “extreme”.

Line 112, use “the differences in the trends between” to replace “the interannual variation trend differences for”.

Line 117, use “rainstorm, especially large rainstorms, have presented a significant increase trend” to replace “rainstorm and especially large rainstorm extreme events presented significantly an increased trend”.

Line 118, delete an extra comma.

Line 119-121, the sentences can be rephrased as “To compare, stations in the Tibetan Plateau (at height of >4000m), a relative clean area in China, were selected for statistical analysis of interannual variation trend of light rain frequency. The results suggest an insignificant decreasing trend for light rain frequency in the Tibetan Plateau (Fig. 3b, A)”.

Line 123-126, the sentence can be rephrased as “The areas with negative trends in light rain frequency almost matched with areas with positive trends in visibility and haze frequency in EC (Fig. 4a,b and c), which are well consistent with the area of high aerosol concentrations and frequent haze events (Fig.2a,b). The light rain frequency reduction in China was closely associated with the enhancement of aerosol levels in the atmosphere (Qian et al., 2009).”

Line 123-126, what is light rain frequency? Is it the number of days with light rain in a year? What are visibility and haze frequencies? Please define them clearly in the paper.

Line 127, The sentence can be rephrased as “The areas with negative trends in light rain almost covered eastern China and a large part of China”.

Line 142-143, change the phrase as “make the number of cloud droplets increase but the size of cloud droplets decrease”.

Line 159-160, change the phrase as “As shown in Fig. 6b (left), in the three periods”.

Line 171, use “significant increasing trends” instead.

Line 176, delete “could”.

Line 197, use “PM_{2.5}” instead.

Lines 198, 219, 225, 226, add “s” after “concentration”.

Lines 220, 225, 226, delete “s” after “droplet”.

Line 224, use “These aircraft observations showed” instead.

Line 229, use “and the effects depend” to replace “depending”.

Line 235, delete “trend”.

Line 236, delete extra space between occurrence and more. Add a space between “with” and “an”

Line 237, add “the” before “1960”

Line 234, delete “of precipitation events” before “and”.

There are various problems in the figures, their captions and annotations. The following are some examples for the authors to take into consideration.

1. Be consistent with the figure format;
2. Use the consistent fonts and font size;
3. Use correct term to label x-axis and y-axis.
4. Use capitalized words to label x-axis and y-axis;
5. Label sub-plots using letters (usually at the top, top-left, or top-right of a sub-plot);
6. Use superscripts and subscripts when necessary;
7. Provide the unit for the variable displayed if no unit, indicate with dimensionless or “(-)”;
8. Indicate the unit for the color bar.
9. Remove zeros for the most insignificant digit after a decimal.
10. Add significant level (p value) on trends.
11. It is better to indicate latitude/longitude in the China maps in Figures 4 and 5.

Figure 2. Labelling sub-plots (a) and (b). Capitalize “pressure” for the label for the y-axis in Figure 2a. It should be “ Pressure (hPa)” so to leave a space between “pressure” and its unit. In the caption, wind speed should have a unit of $m s^{-1}$. Please use correct superscripts.

Figure 3. Use the same font and font size to label sub-plots. No need for zeros after a decimal point in y-axis. Label “Precipitation” or “Rain” for the y-axis in Figure 3a. Use “Year” to label x-axis (not “date”). Add significant level (p-value).

Figure 4. Label (a), (b), (c) for the subplots. Provide the unit for haze frequency, visibility, and light rain frequency. Indicate what the dots and the background stand for. Indicate the unit for the color bar.

Figure 5. Label (a) and (b) for the subplots. Provide the unit for the trend of the rainstorm frequency. Indicate what the dots and the background stand for. Indicate the unit for the color bar.

Figure 6. Label (a), (b) and (c) for the subplots. In Figure 6a, no color is needed as this will cause confusion with Figure 6b and 6c. Good titles for each figure will help readers to understand the differences between Figure 6a and Figure 6b and 6c. Otherwise, the figure can be quite confusion. In the caption, it is better to use “the positive (negative) trend” than “the positive (negative) variability”.

Figure 7. Label sub-plots at the top, top-left, or top-right. Remove zeros for the most insignificant digit after a decimal. Keep sub-plots (a) –(d) the same size.

Figure 9. Provide the unit for the dots.

Figure 10. For the label for the c-axis, remove “index”.

Figure 11. What are the different marks in Figure 11a?